



FLEXURAL STRENGTHENING OF REINFORCED CONCRETE BEAMS WITH CFRP AND STEEL BARS IN COVERING CONCRETE

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Abstract: The strengthening technique which uses embedded bars into the cover concrete, known as near surface mounted (NSM) reinforcement, has been shown to be effective and advantageous, because the strengthening material is protected against vandalism and temperature variation and the dimensions of the strengthened structure are practically unchanged. Four reinforced concrete beams with 150 mm x 250 mm x 2800 mm were strengthened with bars and strips in covering concrete and were tested. The average compressive concrete strength was 45 MPa. The varied parameters were the type of the strengthening material (steel or CFRP) and its ratio. Loads and failure modes; deflections; strains in concrete, internal reinforcement and near surface reinforcement and flexural crack widths were evaluated. It was found that the NSM reinforcement increased the resistance capacity and flexural stiffness of the beams, decreasing its deflection and flexural crack width values. The end anchoring system of NSM reinforcement, formed by "U" single-directional CFRP sheet stirrups, was able to prevent premature rupture by concrete detachment along the inner longitudinal reinforcement or NSM reinforcement debonding. The experimental ultimate capacities of all strengthened beams were compared with the non-strengthened beams and with the theoretical predictions.

Keywords: near surface mounted, CFRP, reinforced concrete, beam, experimental